4c) Find the total number of calories burned over [6, 18]

$$\underset{\text{calories}}{\text{Total}} = \underset{\text{calories}}{\text{initial}} + \underset{[6,18]}{\text{total change}}$$

a. derivative or instantaneous r.o.c.

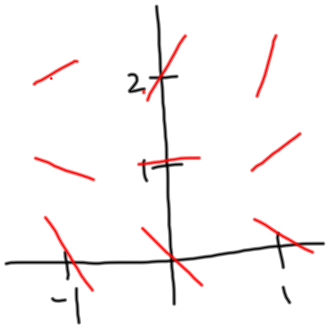
$$= 0 + \int_6^{18} f(t)\,dt$$

base height $h_1 + h_2$ 6 base height

$$= \text{Area from } 6 \mapsto 18 = 6 \cdot 9 + \tfrac{1}{2}(9+15)(4) + 2(15)$$

$$= 54 + 48 + 30 = 132$$

2007/5 $\frac{dy}{dx} = \frac{1}{2}x + y - 1$



at $(-1,2)$ $\frac{dy}{dx} = -\frac{1}{2} + 2 - 1$
$= \frac{1}{2}$

$(-1,1)$ $\frac{dy}{dx} = -\frac{1}{2} + 1 - 1$
$= -\frac{1}{2}$

$(-1,0) \Rightarrow -\frac{1}{2} + 0 - 1 = -\frac{3}{2}$

$(0,2) \Rightarrow 1$

$(0,1) \Rightarrow 0$

$(0,0) \Rightarrow -1$

$(1,2) \Rightarrow \frac{3}{2}$

$(1,1) \Rightarrow \frac{1}{2}$

$(1,0) = -\frac{1}{2}$

b) $\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{1}{2}x + y - 1\right)$

$= \frac{1}{2} + \frac{dy}{dx} = \frac{1}{2} + \left(\frac{1}{2}x + y - 1\right)$

$\frac{d^2y}{dy^2} = \frac{1}{2}x + y - \frac{1}{2}$

c) at $(0,1)$

$\frac{dy}{dx} = 0$. so it is a critical point.

as "x moves, from 0, to the right"

$\frac{dy}{dx} = \frac{1}{2}x + y - 1$ becomes positive
so function is increasing

as x "moves left" from 0,

$\frac{dy}{dx}$ becomes negative,
so function, to the immediate left of $x=0$, is decreasing

Since $f(x)$ changes from decreasing to increasing, $f(x)$ has a rel. min at $(0,1)$

Alternatively
$\frac{d^2y}{dx^2} = \frac{1}{2}x + y - \frac{1}{2}$ at $(0,1)$ is $\frac{1}{2}$, so $f(x)$ is concave up.
and therefore, $f(x)$ has a rel. min at $(0,1)$

2007 b continued

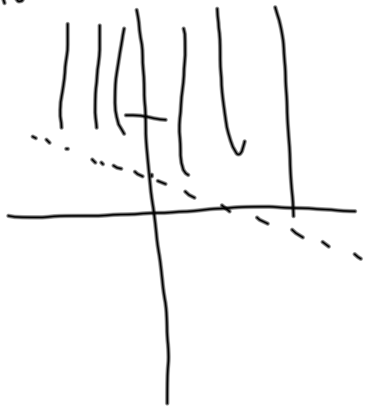
$$\frac{d^2y}{dx^2} = \frac{1}{2}x + y - \frac{1}{2}$$

The solution curves are concave up when $\frac{d^2y}{dx^2}$ is positive.

i.e. $\frac{1}{2}x + y - \frac{1}{2} > 0$

$\frac{1}{2}x + y > \frac{1}{2}$

$y > \frac{1}{2}(1 - x)$



d) $y = mx + b$.

$\frac{dy}{dx} = m$

This is a solution to our diff. eq. when

$\frac{dy}{dx} = \frac{1}{2}x + y - 1 = m$

i.e. $y = -\frac{1}{2}x + \boxed{m+1} = mx + b$

$m = -\frac{1}{2}$, $b = m + 1 = -\frac{1}{2} + 1 = \frac{1}{2}$

2009 B
1c

$$\int_0^3 A'(t)\,dt = A(3) - A(0) \text{ by FTC}$$

$A(t)$ is an antiderivative of $A'(t)$.

Accumulation idea $\int_0^3 A'(t)\,dt$ is the total change in area between $[0, 3]$ $t = 0$ years and $t = 3$ years

total area = starting area (36π) + total change in area

radius at t = radius at 0 + total change in radius from $0 \to t$

$$\left[6 + \int_0^3 \pi 6(3+\sin t^2)\ldots\right]^2$$

Mar 8-8:37 AM